Claim 39:

With respect to claim 39, McNeilly neither teaches nor suggests (1) an apparatus for applying a liquid film of solvent on a surface of a wafer and delivering at least one reactive gas to the surface of the wafer, with the liquid solvent comprising "a transport medium which carries at least some of the at least one reactive gas through the film to" the surface of the wafer or (2) "a temperature controller positioned and operable to maintain the at least one wafer at a temperature equal to or lower than about a dew point of the solvent" as recited in claim 39.

In contrast to the claimed apparatus, McNeilly is understood to disclose an apparatus that is operable to pre-clean wafers of contaminants prior to etching and subsequently etch the wafers using conventional vapor phase etching techniques. See col. 3, lines 53-62 of McNeilly. More specifically, and referring to FIG. 1 of McNeilly, an apparatus 1 comprises an ozone generator 25 connected to a chamber 2 via an inlet 13. The ozone generator is used to introduce ozone into the chamber 2 for pre-cleaning wafers prior to etching. See col. 10, lines 54-56 of McNeilly. For etching the wafers after the pre-cleaning step, vaporizers 21 and 22 (which may comprise the flash evaporator 59 of FIG. 4) deliver HF/H_2O to the chamber via inlet 13.

Thus, in McNeilly, the ozone is introduced into the chamber first and cleans the wafer of contaminants without a film of liquid solvent on the wafer serving as a transport medium for the ozone. After this pre-cleaning step, the HF/H_2O is introduced into the chamber to etch the wafer, not to serve as a transport medium for the ozone. However, in the claimed invention, a liquid solvent is introduced in the chamber to form a film of liquid solvent on a surface of the wafer. This film serves as a transport medium for a reactant gas by carrying the gas through the film to the surface of the wafer.

The Examiner incorrectly asserts that the argon and nitrogen gases from gas source 29 are equivalent to the recited transport medium (see page 3, lines 7-10 of the Examiner's action). The

transport medium is recited in the present claim as being a "film of liquid solvent." The argon or nitrogen taught by McNeilly are not liquids and do not form a "film of liquid solvent." The atmosphere in the McNeilly apparatus would have to be at least less than about -190°C for these gases to form a liquid. Clearly, the McNeilly reference does not teach or suggest a cryogenic atmosphere sufficient to cause these gases to form a liquid.

In addition, McNeilly does not teach or suggest a temperature controller for maintaining the temperature of the wafer at a temperature at or below the dew point of the solvent, as recited by claim 39. The Examiner incorrectly contends that the cooling coils 31 of McNeilly are equivalent to the claimed temperature controller. The cooling coils 31 of McNeilly are configured to cool the *walls* of the chamber 2, not the wafers. See col. 12, lines 1-3 of McNeilly. Again, the temperature controller of the claimed invention is operable to cool a wafer inside the chamber.

Thus, applicants' device as set out in claim 39 clearly is patentable over McNeilly.

Claims 40, 41, and 47-49:

Claims 40, 41, and 47-49 depend directly from claim 39 and are allowable for the reasons given above in support of claim 39 and because each claim sets forth an independently patentable combination of features.

For example, claim 47 recites that "the concentration of dissolved gas in the solvent is between about 10% and about 95% by volume." McNeilly does not even disclose a reactant gas that is dissolved in a solvent. As explained above, the argon and nitrogen disclosed in McNeilly and asserted by the Examiner as being equivalent to the presently recited "film of liquid solvent" (see page 3, lines 7-10 of the Examiner's action) are gases and thus clearly are not equivalent to the recited liquid solvent. Furthermore, the Examiner's contention that McNeilly discloses "the concentration of dissolved gas in the

solvent is 6.17% (col. 8, line 29)" is of no relevance. First, 6.17% is outside the range specified in claim 47. Second, the portion of McNeilly cited by the Examiner states that 6.17% is "the average one-stigma uniformity value." This has nothing to do with the concentration of a gas in a solvent. Lastly, in McNeilly, the only gas that is mixed with the HF/H_2O is an inert gas (i.e., a non-reactive gas) that serves as a carrier for the vaporized HF/H_2O. In short, McNeilly is completely irrelevant to the presently claimed invention.

In addition, claim 49 recites that the "solvent is a perfluorocarbon." However, since the Examiner has conceded that McNeilly does not disclose the use of a perfluorocarbon (see page 5, line 9 of the Examiner's action), McNeilly cannot anticipate claim 49.

Claims 42 and 43:

Independent claim 42 is not anticipated by McNeilly because McNeilly neither teaches nor suggests at least the following features of claim 42: (1) a "wafer positioned in the wafer carrier in a substantially vertical position" or (2) "a liquid depositor adapted to produce a stream of liquid . . . in a direction substantially parallel to the at least one major surface of the wafer" or (3) a "liquid layer transporting ozone gas to the surface of the wafer." The Examiner even concedes that McNeilly does not disclose wafers supported in a substantially vertical position (see page 5, lines 1-2 of the Examiner's action). Thus, McNeilly cannot anticipate claim 42.

Claim 43 depends from claim 42 and is allowable for the reasons given above in support of claim 42 and because it sets forth an independently patentable combination of features. For example, the McNeilly apparatus does not have a temperature controller for controlling the temperature of a wafer, as recited by claim 43.

Claims 44 and 45:

McNeilly neither teaches nor suggests at least the following features of independent claim 44: (1) a liquid layer former operable to form a layer of liquid on at least one major surface of a wafer whereby a reactant gas is transported through the liquid layer to the wafer surface or (2) a temperature controller "operable to cool the at least one wafer in the chamber."

Claim 45 depends from claim 44 and is allowable for the reasons given in support of claim 44 and because it sets forth an independently patentable combination of features.

Claim 46:

McNeilly neither teaches nor suggests at least the following features of independent claim 46: (1) "a film former adapted to condense a solvent to form a film of liquid solvent onto a surface of the wafer which is to be stripped of photo-resist" or (2) "a cooling mechanism operable to cool the surface of the wafer" or (3) a gas exposer adapted to expose the film of liquid solvent to a reactant gas such that the gas "is transported through the film of liquid solvent to the wafer surface."

With respect to claim 46, the Examiner mischaracterizes the McNeilly reference. In particular, McNeilly does not, as contended by the Examiner, disclose a film former adapted to condense a solvent on a wafer that is to be stripped of photoresist. As already explained, the McNeilly process involves removing contaminants (e.g., photoresist) on the wafers with ozone in a pre-treatment process prior to introducing any vaporized liquid (e.g., vapor phase etchants) into the chamber. This pre-treatment purportedly improves etch uniformity. See, e.g., col. 2, lines 22-27 of McNeilly. Consequently, when the vaporized liquid of McNeilly is introduced into the chamber for the purpose of etching the wafers, the wafers are free of any contaminants, such as photoresist. Thus, unlike the claimed structure, McNeilly

does not disclose a film former adapted to condense a film of liquid solvent on a wafer that is to be stripped of photoresist.

Moreover, table 3 of McNeilly (which is improperly cited by the Examiner as disclosing the film former of claim 46) discloses the results of a test in which HMDS (hexamethyl-di-silizane) contaminated wafers were exposed to either O_3 or N_2. This table is completely irrelevant to the recited invention of claim 46.

Claim 50:

With respect to independent claim 50, McNeilly neither teaches nor suggest a solvent layer on a wafer wherein the solvent is inert to the wafer surface but dissolves at least some of a reactive gas such that some of the dissolved gas is brought into direct contact with and chemically reacts with the surface of the wafer. As discussed above, the Examiner incorrectly purports that the argon and nitrogen gases from gas source 29 of McNeilly form a liquid layer of solvent.

Claims 51-54:

With respect to independent claim 51, as discussed above McNeilly neither teaches nor suggests a condensed liquid solvent film or layer on a wafer wherein the solvent comprises a transport medium for dissolving at least some of a reactive gas such that the gas chemically reacts with a surface of a wafer.

Claims 52-54 depend from claim 51 and are allowable for the reasons given above in support of claim 51 and because each claim sets forth an independently patentable combination of features.

For example, McNeilly neither teaches nor suggests that the apparatus includes a temperature controller (as recited in claim 52) or that the concentration of dissolved gas in the solvent is between about 10% and 95% by volume (as recited in claim 54). As to claim 53, McNeilly does not, as contended

by the Examiner, disclose a film of solvent at all, let alone a film of solvent having a thickness of about 1 μm to about 3000 μm. For support, the Examiner cites Table 4 and 5 of McNeilly, which provide data relating to etching uniformity. Tables 4 and 5 are completely unrelated and irrelevant to the apparatus recited in claim 53.

Claim 55:

As set forth above, McNeilly neither teaches nor suggests at least the following features of claim 55: (1) "a temperature control device adapted to cool the at least one wafer" or (2) a liquid solvent layer on a wafer wherein the solvent layer comprises a transport medium which dissolves at least some of a reactive gas such that the dissolved gas is brought into direct contact with and chemically reacts with a surface of a wafer.

Claim 56:

McNeilly neither teaches nor suggests at least the following features of claim 56: (1) "a nebulizer adapted to create a mist of a solvent" or (2) "a temperature control device operable to cool the wafer such that the mist of solvent condenses on" the wafer to form a film of liquid solvent or (3) a gas source for delivering a reactant gas to the wafer, wherein the liquid solvent serves as a transport medium for the reactant gas.

The nebulizer of the claimed invention is operable to introduce a mist of solvent in the liquid phase. See page 10, lines 12-16 of Applicants' specification. At best, the McNeilly apparatus includes vaporizers 21 and 23 for introducing vaporized (i.e., gaseous) etchants into the chamber. Nowhere in McNeilly is there support for a nebulizer (nor has the Examiner claimed that there is any such support).

In view of the foregoing, claims 39-56 are clearly patentable over McNeilly and the 35 U.S.C. § 102(e) rejection of claims 39-56 should be withdrawn.

II. Rejection of claims 42 and 49 Under 35 U.S.C. § 103(a)

Claim 42 was rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over McNeilly in view of U.S. Patent No. 4,795,497 to McConnell et al., (hereinafter McConnell) and claim 49 was rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over McNeilly in view of U.S. Patent No. 4,946,549 to Bachman et al., (hereinafter Bachman). Applicants traverse these rejections.

Claim 42:

To establish a prima facie case of obviousness, the prior art references must teach or suggest all claim limitations recited in the subject claim. MPEP § 2142, p. 2100-121 (2001). As discussed above, the primary reference cited by the Examiner in this case, McNeilly, neither teaches nor suggests at least the following features of claim 42: (1) a "wafer positioned in the wafer carrier in a substantially vertical position" or (2) "a liquid depositor adapted to produce a stream of liquid . . . in a direction substantially parallel to the at least one major surface of the wafer" or (3) a "liquid layer transporting ozone gas to the surface of the wafer." McConnell does not make up for the deficiencies of McNeilly.

The Examiner contends that "it would have been obvious to one with ordinary skill in the art to have a vertical [sic] positioned wafer within the treatment chamber [such as shown in McConnell] in order to drain the cleaning off [sic] the wafer surface." (see page 5, lines 5-7 of the Examiner's action). Not only is this contention unsupported by evidence, it is clearly incorrect.

When combining prior art references to support a prima facie case of obviousness, there must be some teaching or suggestion in the prior art to make the proposed combination. The teaching or

suggestion to make the proposed combination must be found in the prior art, and not based on applicants' disclosure. MPEP § 2142, p. 2100-121 (2001). In the present case, the McConnell reference cannot be properly combined with the McNeilly reference because McConnell teaches away from the claimed combination.

For example, claim 42 recites forming a liquid layer on a surface of a wafer. McConnell, however, specifically teaches away from forming a film or layer of liquid solvent on the wafer surface. See, e.g., col. 3, lines 13-21, where McConnell states that "'filming' effects are avoided." See also, col. 10, lines 42-49, where McConnell states that the treatment loop should be full, having no phase boundaries, "so that the fluid may circulate in a uniform fashion, without droplets, films or other irregularities which could degrade the wafer treatment process."

Moreover, because McConnell does not teach or suggest at least a "liquid layer transporting ozone gas to the surface of the wafer," McConnell does not make up for the deficiencies of the McNeilly primary reference.

For at least the foregoing reasons, claim 42 is allowable over McNeilly and McConnell, whether considered independently or in combination.

Claim 49:

As discussed above in section I, claim 49 is allowable for the reasons set forth above in support of its parent claim (claim 39). Claim 49 is also patentable independent of claim 39 because neither McNeilly or McConnell (independently or in combination) teach or suggest a liquid solvent as recited in the present claims, let alone a perfluorocarbon liquid solvent, as recited by claim 49.

The Examiner contends that Bachman discloses the claimed perfluorocarbon solvent. Applicants disagree.

The section of Bachman cited by the Examiner in support of the rejection of claim 49 (col. 2, lines 59-67) discusses conventional plasma etching techniques that involve various gases, such as O_2, H_2, N_2O, CF_4, NF_3, and SF_6. There is no support here for a perfluorocarbon liquid solvent that serves as a transport medium for a reactant gas, as recited in claim 49.

Thus, for at least the foregoing reasons, claim 49 is allowable over McNeilly and Bachman, whether considered independently or in combination.

III. Conclusion

The present application is in condition for allowance and such action is respectfully requested. If any further issues remain concerning this application, the Examiner is invited to call the undersigned to discuss such matters.

Respectfully submitted,

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